

WHAT IS CLAIMED IS:

1. A manufacturing method for a semiconductor device, which includes performing heat treatment using a heat source for radiating an incoherent electromagnetic wave within a wavelength band ranging at least from a visible light band to an infrared band, comprising:

forming a conductive layer heated by radiation of the electromagnetic wave over a substrate;

forming a semiconductor layer formed inside the conductive layer and an insulating layer covering a top surface and a side surface of the semiconductor layer wherein the semiconductor layer and the insulating layer are interposed between the substrate and the conductive layer ; and

selectively heating a region where the conductive layer is formed, by irradiating the electromagnetic wave to thereby conduct the heat treatment on the semiconductor layer and the insulating layer.

2. A manufacturing method for a semiconductor device, comprising:

forming over a substrate a conductive layer patterned to have a length of one side not larger than a thickness of the substrate;

forming a semiconductor layer formed inside the conductive layer and an insulating layer covering a top surface and a side surface of the semiconductor layer wherein the semiconductor layer and the insulating layer are interposed between the substrate and the conductive layer; and

selectively heating a region where the conductive layer is formed, by using a heat source for irradiating an incoherent light within a wavelength band ranging at least from a visible light band to an infrared band to thereby conduct heat treatment on the semiconductor

layer and the insulating layer.

3. A manufacturing method for a semiconductor device, comprising:

forming, semiconductor layers that are divided from each other in an island-like shape over a substrate having an insulating surface;

forming a conductive layer covering an entire surface of each of the semiconductor layers and having ends situated outside each of the semiconductor layers, over each of the semiconductor layers through an insulating layer; and

selectively heating a region where the conductive layer is formed, by irradiating an incoherent electromagnetic wave within a wavelength band ranging at least from a visible light band to an infrared band to thereby conduct heat treatment on each of the semiconductor layers and the insulating layer.

4. A manufacturing method for a semiconductor device, comprising:

forming a first insulating layer over a substrate having an insulating surface;

forming semiconductor layers that are divided from each other in an island-like shape over the first insulating layer;

forming a second insulating layer that covers a top surface and a side surface of each of the semiconductor layers;

forming a conductive layer that covers the top surface and an end surface of each of the semiconductor layers and having ends situated outside each of the semiconductor layers, over the second insulating layer;

selectively heating a region where the conductive layer is formed, by irradiating an incoherent electromagnetic wave within a wavelength band ranging at least from a visible

light band to an infrared band to thereby conduct heat treatment on each of the semiconductor layers and the insulating layer; and

forming a gate electrode overlapping with each of the semiconductor layers by etching the conductive layer.

5. A manufacturing method for a semiconductor device, comprising:

forming semiconductor layers that are divided from each other in an island-like shape over a substrate;

forming a conductive layer covering an entire surface of each of the semiconductor layers and having ends situated outside each of the semiconductor layers, over each of the semiconductor layers through an insulating layer;

irradiating an incoherent electromagnetic wave within a wavelength band ranging at least from a visible light band to an infrared band for 30 to 300 seconds; and

selectively heating a region where the conductive layer is formed to thereby conduct heat treatment on each of the semiconductor layers and the insulating layer.

6. A manufacturing method for a semiconductor device according to claim 1, the substrate is glass substrate.

7. A manufacturing method for a semiconductor device according to claim 2, the substrate is glass substrate.

8. A manufacturing method for a semiconductor device according to claim 3, the substrate is glass substrate.

9. A manufacturing method for a semiconductor device according to claim 4, the substrate is glass substrate.

10. A manufacturing method for a semiconductor device according to claim 5, the substrate is glass substrate.

11. A manufacturing method for a semiconductor device according to claim 1, the substrate is selected from one of quartz and sapphire.

12. A manufacturing method for a semiconductor device according to claim 2, the substrate is selected from one of quartz and sapphire.

13. A manufacturing method for a semiconductor device according to claim 3, the substrate is selected from one of quartz and sapphire.

14. A manufacturing method for a semiconductor device according to claim 4, the substrate is selected from one of quartz and sapphire.

15. A manufacturing method for a semiconductor device according to claim 5, the substrate is selected from one of quartz and sapphire.

16. A manufacturing method for a semiconductor device according to claim 1, the substrate has a transmittance of 50 % or higher with respect to the electromagnetic wave

within the wavelength band.

17. A manufacturing method for a semiconductor device according to claim 2, the substrate has a transmittance of 50 % or higher with respect to the electromagnetic wave within the wavelength band.

18. A manufacturing method for a semiconductor device according to claim 3, the substrate has a transmittance of 50 % or higher with respect to the electromagnetic wave within the wavelength band.

19. A manufacturing method for a semiconductor device according to claim 4, the substrate has a transmittance of 50 % or higher with respect to the electromagnetic wave within the wavelength band.

20. A manufacturing method for a semiconductor device according to claim 5, the substrate has a transmittance of 50 % or higher with respect to the electromagnetic wave within the wavelength band.

21. A manufacturing method for a semiconductor device according to claim 1, wherein the conductive layer is formed of a metal nitride.

22. A manufacturing method for a semiconductor device according to claim 2, wherein the conductive layer is formed of a metal nitride.

23. A manufacturing method for a semiconductor device according to claim 3, wherein the conductive layer is formed of a metal nitride.

24. A manufacturing method for a semiconductor device according to claim 4, wherein the conductive layer is formed of a metal nitride.

25. A manufacturing method for a semiconductor device according to claim 5, wherein the conductive layer is formed of a metal nitride.

26. A manufacturing method for a semiconductor device according to claim 1, further comprising forming a second conductive layer on the conductive layer and forming a part of a gate electrode using the conductive layer.

27. A manufacturing method for a semiconductor device according to claim 2, further comprising forming a second conductive layer on the conductive layer and forming a part of a gate electrode using the conductive layer.

28. A manufacturing method for a semiconductor device according to claim 3, further comprising forming a second conductive layer on the conductive layer and forming a part of a gate electrode using the conductive layer.

29. A manufacturing method for a semiconductor device according to claim 4, further comprising forming a second conductive layer on the conductive layer and forming a part of a gate electrode using the conductive layer.

30. A manufacturing method for a semiconductor device according to claim 5, further comprising forming a second conductive layer on the conductive layer and forming a part of a gate electrode using the conductive layer.

31. A manufacturing method for a semiconductor device according to claim 1, wherein the heat treatment is performed at a temperature not less than a distortion point of the substrate.

32. A manufacturing method for a semiconductor device according to claim 2, wherein the heat treatment is performed at a temperature not less than a distortion point of the substrate.

33. A manufacturing method for a semiconductor device according to claim 3, wherein the heat treatment is performed at a temperature not less than a distortion point of the substrate.

34. A manufacturing method for a semiconductor device according to claim 4, wherein the heat treatment is performed at a temperature not less than a distortion point of the substrate.

35. A manufacturing method for a semiconductor device according to claim 5, wherein the heat treatment is performed at a temperature not less than a distortion point of the substrate.

36. A manufacturing method for a semiconductor device, comprising:
heating an entire surface of a substrate by radiation heating from a first heat source;
forming non-transparent layers that are separated from each other in an island-like shape over the substrate, the non-transparent layers each having a different, higher absorptance with respect to an incoherent electromagnetic wave within a wavelength band ranging at least from a visible light band to an infrared band, than the substrate; and
locally heating a region where each of the non-transparent layers having the high absorptance with respect to the incoherent electromagnetic wave is formed, by using a second heat source for radiating the incoherent electromagnetic wave.

37. A manufacturing method for a semiconductor device, comprising:
heating an entire surface of a substrate by radiation heating from a first heat source;
forming a non-transparent layer to overlap with a semiconductor layer formed in an island-like shape through an insulating film over the substrate, the non-transparent layer having a different, higher absorptance with respect to an incoherent electromagnetic wave within a wavelength band ranging at least from a visible light band to an infrared band, than the substrate; and
selectively heating a region where the non-transparent layer having the high absorptance with respect to the incoherent electromagnetic wave is formed, by using a second heat source for radiating the incoherent electromagnetic wave to thereby conduct heat treatment on the semiconductor layer and the insulating layer through conductive heating from the non-transparent layer having the high absorptance with respect to the electromagnetic wave.

38. A manufacturing method for a semiconductor device according to claim 36, the substrate is glass substrate.

39. A manufacturing method for a semiconductor device according to claim 37, the substrate is glass substrate.

40. A manufacturing method for a semiconductor device according to claim 36, the substrate is selected from one of quartz and sapphire.

41. A manufacturing method for a semiconductor device according to claim 37, the substrate is selected from one of quartz and sapphire.

42. A manufacturing method for a semiconductor device according to claim 36, the substrate has a transmittance of 50 % or higher with respect to the electromagnetic wave within the wavelength band

43. A manufacturing method for a semiconductor device according to claim 37, the substrate has a transmittance of 50 % or higher with respect to the electromagnetic wave within the wavelength band

44. A manufacturing method for a semiconductor device according to claim 36, the insulating layer covers a top surface and a side surface of each of the semiconductor layers.

45. A manufacturing method for a semiconductor device according to claim 37, the insulating layer covers a top surface and a side surface of each of the semiconductor layers.

46. A manufacturing method for a semiconductor device according to claim 36, the insulating layer includes a laminate of a silicon oxide film and a silicon nitride film

47. A manufacturing method for a semiconductor device according to claim 37, the insulating layer includes a laminate of a silicon oxide film and a silicon nitride film

48. A manufacturing method for a semiconductor device according to claim 36, wherein the non-transparent layer having the high absorptance is formed of a high melting-point metal selected from the group consisting of molybdenum (Mo), tungsten (W), titanium (Ti), and chromium (Cr).

49. A manufacturing method for a semiconductor device according to claim 37, wherein the non-transparent layer having the high absorptance is formed of a high melting-point metal selected from the group consisting of molybdenum (Mo), tungsten (W), titanium (Ti), and chromium (Cr).

50. A manufacturing method for a semiconductor device according to claim 36, wherein the non-transparent layer having the high absorptance is formed of a metal nitride selected from the group consisting of titanium nitride (TiN), tantalum nitride (TaN), and tungsten nitride (WN).

51. A manufacturing method for a semiconductor device according to claim 37, wherein the non-transparent layer having the high absorptance is formed of a metal nitride selected from the group consisting of titanium nitride (TiN), tantalum nitride (TaN), and tungsten nitride (WN).

52. A manufacturing method for a semiconductor device according to claim 36, wherein the non-transparent layer having the high absorptance is formed of one selected from the group consisting of tungsten silicide (WSi₂), molybdenum silicide (MoSi₂), titanium silicide (TiSi₂), tantalum silicide (TaSi₂), chromium silicide (CrSi₂), cobalt silicide (CoSi₂), and platinum silicide (PtSi₂).

53. A manufacturing method for a semiconductor device according to claim 37, wherein the non-transparent layer having the high absorptance is formed of one selected from the group consisting of tungsten silicide (WSi₂), molybdenum silicide (MoSi₂), titanium silicide (TiSi₂), tantalum silicide (TaSi₂), chromium silicide (CrSi₂), cobalt silicide (CoSi₂), and platinum silicide (PtSi₂).

54. A manufacturing method for a semiconductor device according to claim 36, wherein the substrate has a transmittance of 60% or higher with respect to the incoherent electromagnetic wave within the wavelength band ranging from the visible light band to the infrared band and the non-transparent layer having the high absorptance has a transmittance of 30% or lower with respect to the incoherent electromagnetic wave within the wavelength band ranging from the visible light band to the infrared band.

55. A manufacturing method for a semiconductor device according to claim 37, wherein the substrate has a transmittance of 60% or higher with respect to the incoherent electromagnetic wave within the wavelength band ranging from the visible light band to the infrared band and the non-transparent layer having the high absorptance has a transmittance of 30% or lower with respect to the incoherent electromagnetic wave within the wavelength band ranging from the visible light band to the infrared band.

56. A manufacturing method for a semiconductor device according to claim 36, wherein the second heat treatment step is performed at a temperature not lower than a distortion point of the substrate.

57. A manufacturing method for a semiconductor device according to claim 37, wherein the second heat treatment step is performed at a temperature not lower than a distortion point of the substrate.

58. A heat treatment method comprising:

contracting a glass substrate, the first heat treatment step including a step of heating an entire surface of the glass substrate and a step of subsequently cooling the glass substrate down to a room temperature;

forming non-transparent layers that are separated from each other in an island-shape over the glass substrate, the non-transparent layers each having a different, higher absorptance with respect to an incoherent electromagnetic wave within a wavelength band ranging at least from a visible light band to an infrared band, than the glass substrate; and

locally heating a region where each of the non-transparent layers having the high

absorptance with respect to the electromagnetic wave is formed, by radiation heat of the incoherent electromagnetic wave.

59. A heat treatment method comprising:

contracting a glass substrate, the first heat treatment step including a step of heating an entire surface of the glass substrate and a step of subsequently cooling the glass substrate down to a room temperature;

forming a non-transparent layer to overlap with a semiconductor layer formed in an island-like shape through an insulating film over the glass substrate, the non-transparent layer having a different, higher absorptance with respect to an incoherent electromagnetic wave within a wavelength band ranging at least from a visible light band to an infrared band, than the glass substrate; and

locally heating a region where the non-transparent layer having the high absorptance with respect to the electromagnetic wave is formed, by radiation heat of the incoherent electromagnetic wave to thereby conduct heat treatment on the semiconductor layer and the insulating film through conductive heating from the non-transparent layer having the high absorptance with respect to the electromagnetic wave.

60. A heat treatment method according to claim 58, wherein the non-transparent layer having the high absorptance is formed of a high melting-point metal selected from the group consisting of molybdenum (Mo), tungsten (W), titanium (Ti), and chromium (Cr).

61. A heat treatment method according to claim 59, wherein the non-transparent layer having the high absorptance is formed of a high melting-point metal selected from the

group consisting of molybdenum (Mo), tungsten (W), titanium (Ti), and chromium (Cr).

62. A heat treatment method according to claim 58, wherein the non-transparent layer having the high absorptance is formed of a metal nitride selected from the group consisting of titanium nitride (TiN), tantalum nitride (TaN), and tungsten nitride (WN).

63. A heat treatment method according to claim 59, wherein the non-transparent layer having the high absorptance is formed of a metal nitride selected from the group consisting of titanium nitride (TiN), tantalum nitride (TaN), and tungsten nitride (WN).

64. A heat treatment method according to claim 58, wherein the non-transparent layer having the high absorptance is formed of one selected from the group consisting of tungsten silicide (WSi_2), molybdenum silicide (MoSi_2), titanium silicide (TiSi_2), tantalum silicide (TaSi_2), chromium silicide (CrSi_2), cobalt silicide (CoSi_2), and platinum silicide (PtSi_2).

65. A heat treatment method according to claim 59, wherein the non-transparent layer having the high absorptance is formed of one selected from the group consisting of tungsten silicide (WSi_2), molybdenum silicide (MoSi_2), titanium silicide (TiSi_2), tantalum silicide (TaSi_2), chromium silicide (CrSi_2), cobalt silicide (CoSi_2), and platinum silicide (PtSi_2).

66. A heat treatment method according to any one of claim 58, wherein the glass substrate has a transmittance of 60% or higher with respect to the incoherent electromagnetic

wave within the wavelength band ranging from the visible light band to the infrared band and the non-transparent layer having the high absorptance has a transmittance of 30% or lower with respect to the incoherent electromagnetic wave within the wavelength band ranging from the visible light band to the infrared band.

67. A heat treatment method according to any one of claim 59, wherein the glass substrate has a transmittance of 60% or higher with respect to the incoherent electromagnetic wave within the wavelength band ranging from the visible light band to the infrared band and the non-transparent layer having the high absorptance has a transmittance of 30% or lower with respect to the incoherent electromagnetic wave within the wavelength band ranging from the visible light band to the infrared band.

68. A heat treatment method according to any one of claim 58, wherein the second heat treatment step is performed at a temperature not less than a distortion point of the glass substrate.

69. A heat treatment method according to any one of claim 59, wherein the second heat treatment step is performed at a temperature not less than a distortion point of the glass substrate.

70. A manufacturing method for a semiconductor device, which includes performing heat treatment by irradiating an electromagnetic wave within a wavelength band ranging at least from a visible light band to an infrared band, comprising:

forming a conductive layer absorbing the electromagnetic wave over a substrate;

forming, between the substrate and the conductive layer, a semiconductor layer formed inside the conductive layer and an insulating layer covering a top surface and a side surface of the semiconductor layer wherein the semiconductor layer and the insulating layer are interposed between the substrate and the conductive layer; and

selectively heating a region where the conductive layer is formed, by irradiating the electromagnetic wave to thereby conduct heat treatment on the semiconductor layer and the insulating layer.

71. A manufacturing method for a semiconductor device according to claim 70, the substrate is glass substrate.

72. A manufacturing method for a semiconductor device according to claim 70, the substrate is selected from one of quartz and sapphire.

73. A manufacturing method for a semiconductor device according to claim 70, the substrate has a transmittance of 50 % or higher with respect to the electromagnetic wave within the wavelength band